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**BTECH**  
**(SEM VII) THEORY EXAMINATION 2024-25**  
**HVAC SYSTEMS**

TIME: 3 HRS

M.MARKS: 100

**Note:** Attempt all Sections. In case of any missing data; choose suitably.

## SECTION A

**1. Attempt all questions in brief. 2 x 10 = 20**

Q no.	Question	CO	Level
a.	Define the effect of superheating on the COP of a vapour compression cycle.	1	K1
b.	What are Hydrofluoro-Olefins, and why are they considered future refrigerants?	1	K2
c.	Explain the significance of Apparatus Dew Point (ADP) in air conditioning systems.	2	K3
d.	What is the bypass factor in a cooling coil? Explain its importance.	2	K2
e.	Differentiate between unitary and central air conditioning systems.	3	K2
f.	Describe the purpose of mechanical ventilation in buildings.	3	K2
g.	What is the shading device? Explain its role in reducing heat gain.	4	K2
h.	Define the stack effect in infiltration load calculations.	4	K1
i.	What is the equal friction method in duct design?	5	K2
j.	Differentiate between centrifugal and axial fans.	5	K2

## SECTION B

**2. Attempt any three of the following: 10 x 3 = 30**

a.	Draw and explain the transcritical vapour compression refrigeration cycle on a P-h chart.	1	K3
b.	Describe the psychrometric processes involved in summer air conditioning.	2	K3
c.	Discuss the advantages and limitations of decentralized heat pumps in industrial applications.	3	K4
d.	Derive an expression to calculate the heat transfer through walls using the decrement factor.	4	K3
e.	Explain the velocity reduction method for duct design with its applications.	5	K2

## SECTION C

**3. Attempt any one part of the following: 10 x 1 = 10**

a.	Explain the classification of refrigerants based on safety standards with examples.	1	K2
b.	Show that, for $t_0 = -15^\circ\text{C}$ and $t_k = 30^\circ\text{C}$ , for isobutane the suction state for maximum COP lies in the superheat region.	1	K3

**4. Attempt any one part of the following: 10 x 1 = 10**

a.	Explain the working principle of an air washer with a hygroscopic solution.	2	K2
b.	Saturated steam at standard atmospheric pressure is injected into a passing air stream in an amount sufficient to raise the absolute humidity from 0.0057 to 0.0143 kg w.v./kg d.a. If the air enters the humidifier at $21^\circ\text{C}$ DBT, determine its leaving state.	2	K3

**5. Attempt any one part of the following: 10 x 1 = 10**

a.	Explain the working of a double-bundle condenser in heat pumps.	3	K2
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b.	A simple saturation ammonia compression system has a high pressure of 1.35 MN/m <sup>2</sup> and a low pressure of 0.19 MN/m <sup>2</sup> . Find per 400,000 kJ/h of refrigerating capacity, the power consumption of the compressor and COP of the cycle.	3	K3
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**6. Attempt any one part of the following: 10 x 1 = 10**

a.	Calculate the heat gain through a glass window using solar radiation data.	4	K3
b.	Explain the concept of energy conservation in air-conditioned buildings.	4	K2

**7. Attempt any one part of the following: 10 x 1 = 10**

a.	Describe the mechanism of flow through supply air outlets in duct systems.	5	K2
b.	Discuss the causes and solutions to vibration and noise in air conditioning piping systems.	5	K3

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